

Application No. 09/727,358
Paper Dated June 24, 2003
Reply to USPTO Correspondence of March 25, 2003
Attorney Docket No. 116-001940

REMARKS

Claims 1-8 remain in the case.

The examiner has dropped the previous rejections, cited a new reference, and finally rejected all claims.

The examiner has rejected claims 1 and 8 as obvious under 35 U.S.C. § 103(a) in view of a single reference, Lo et al. U.S. Patent No. 6,232,787. The examiner states:

As per claim 1, Lo [787] teaches a method of inspecting the state of completeness of the formation of a large number of holes formed in a wafer sample by directing a charged particle beam to the sample and obtaining resulting signals, the method comprising the steps of: establishing measurement of regions containing holes on the sample (114), directing the charged particle beam to the measurement regions on the sample containing holes, and displaying a brightness-based map (figs. 3, 5) on a display unit (156) according to the found data about the distribution. See Lo [787] abstract, figs. 1-4, 7, col. 1 lines 40-45, col. 7 lines 10-49, and col. 9 lines 39-67. However, Lo [787] does not specifically state detecting an electrical current flowing through the wafer sample to ground for each of the measurement regions, nor finding data about a current distribution on the sample from detected values of electric current. Lo [787] does however teach measuring the voltage contrast between the sample and the ground in order to obtain an image of the voltage distribution of the sample. In addition, Lo [787] teaches determining the electrical connectivity of the material within and beneath and comparing this feature in a conventional voltage-contrast or SEM image. Lo [787] also teaches the sample being connected to ground. See Lo [787] col. 2 lines 20-60, col. 3 lines 10-17, 35-60, col. 7 lines 10-50, col. 8 lines 10-65, col. 11 lines 30-45, and col. 15 lines 30-45. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to detect an electrical current flowing through the wafer sample to ground for each of the measurement regions, and find data about a current distribution on the sample from detected values of electric current since the examiner takes Official Notice of the equivalence of the voltage contrast along with the electric connectivity (measurement/determination) and detecting the current for their use in the charged-particle topography art and

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the selection of any of these known equivalents to current detection would be would be within the level of ordinary skill in the art. [Emphasis added.]

Reconsideration is respectfully requested.

Single reference obviousness rejections are unusual. "Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference." In re Kotzab, 55 USPQ.2d 1313 at 1316-17 (Fed. Cir. 2000).

The examiner acknowledges that the Lo et al. '787 patent does not teach detecting an electrical current flowing through the wafer to ground for each of the measurement regions.

What the Lo et al. '787 patent does teach is the examination of the size and shape of secondary electron images of holes. This requires (1) first precharging the wafer with a "flood gun", (2) then observing the secondary electron image of the individual holes, (3) visually or with image processing software comparing the observed size of the individual holes with the expected size of the individual holes, and (4) correlating the relative size of the image of the individual hole with the condition of the hole. (See Fig. 5. Holes 505, 510, and 515 are images of equal size holes. The size of the images of each hole is based on the condition of the hole.)

Applicant's method does not require the visual observation of the image of individual holes and the comparison of the image to the expected image size of a valid hole. Applicant's method does not even consider individual holes, but groups of holes.

To modify the Lo et al. '787 patent for practice of the Applicant's claimed method, it would be necessary (1) to eliminate the step for negatively charging up the wafer
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surface, (2) to eliminate the step for recording a secondary electron image, (3) to eliminate the step for observing the secondary electron image of individual holes, (4) to eliminate the comparison of the size of the secondary electron images of the holes, and (5) to eliminate the correlation or comparison of the images to identify a defect in the hole. It would then be necessary (6) to add means to measure the current flowing through the wafer to ground, (7) to measure the current flowing in the multiple measurement regions, and (8) to display a map based on the current flowing in each measurement region. All of these modifications to the method taught by the Lo et al. '787 patent would be required to provide Applicant's method. The Lo et al. '787 patent itself does not suggest these modifications.

The examiner suggests that the Lo et al. '787 patent "teach measuring the voltage contrast between the sample and the ground". It is respectfully noted that the Lo et al. '787 patent obtains a secondary electron image that is related to the difference in the voltage over the surface of the specimen and not the difference between the sample and ground. There is no suggestion in the Lo et al. '787 patent that the image variation of individual holes can be correlated to a specific voltage difference and that this can be somehow correlated with the current flowing through the wafer to ground at a specific hole, nor is there any suggestion that the images of a group of holes in a measurement region can be correlated with the current flowing through that region to ground.

The examiner states that he is taking Official Notice of the equivalents of the voltage contrast along with the electrical connectivity and detecting the current. The Applicant challenges the taking of this Official Notice. See MPEP §2144.03. While Ohm's Law relates voltage and current between two locations, given a fixed resistance, it is pure speculation that the difference in voltage, which is only generally and not quantifiably

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determined by the difference in the secondary electron images at different locations over the surface of the wafer, is equivalent to a current flowing through the wafer.

Even if this were an accepted fact, it does not suggest all of the changes that would have to be made to the method set forth in the Lo et al. '787 patent to provide Applicant's method.

The examiner has rejected claims 2-7 under 35 U.S.C. § 103(a) as unpatentable over the Lo et al. '787 patent in view of Liu et al. U.S. Patent No. 6,037,588.

The examiner states:

As per claim 2, Lo [787] teaches all aspects of the claim except for specifically stating that the size and positions of the measurement regions should be set so that plural holes are present within each of the measurement regions. Liu [588] does teach the size and positions of the measurement regions being set so that plural holes are present within each of the measurement regions. See Liu [588] fig. 5, col. 8 lines 25-55. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the size and positions of the measurement regions set so that plural holes are present within each of the measurement regions in order to that a great number of contact holes can be analyzed at practically the same time as taught in Liu [588].

Reconsideration is respectfully requested.

It is pointed out with reference to claims 1 and 8 that the Lo et al. patent does not teach all aspects of the claims. Moreover, the Lui et al. '588 patent does not suggest the numerous modifications of the Lo et al. '787 patent required to meet the limitations of claims 1 and 8. As noted in a previous response, the Lui et al. '588 patent requires the destruction of the specimen in the process of depthwise analysis.

While the Lui et al. '588 patent does analyze groups of holes, it would not make sense to attempt to modify the Lo et al. '787 patent in view of the Lui et al. '588 patent

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to analyze groups of holes, since the method of the Lo et al. '787 patent is directed only to consideration of one hole at a time. The size of the image for an individual hole must be compared with a standard.

Claim 3 is not unpatentable over the references cited for the reasons set forth for claims 1 and 2.

Claims 4 and 6 are not obvious in view of the references cited for the reason that the Lo et al. '787 patent does not even measure current flowing through the wafer to ground and, therefore, cannot teach accumulating current.

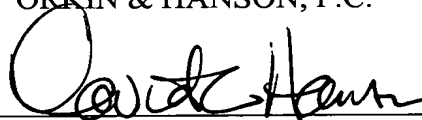
Claims 5 and 7 are not unpatentable in view of the references cited since the Lo et al. '787 patent does not even measure current flowing through the wafer to ground and, therefore, cannot suggest averaging the current.

In view of the foregoing remarks, it is urged this case is now in condition for allowance.

Respectfully submitted,

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